Chemical Opportunities for Lumber Protection

Proceedings of a Workshop

Sponsored by

Forintek Canada Corp.

Council of Forest Industries of British Columbia

March 22, 1985

at

Forintek Canada Corp.

Vancouver, B.C.

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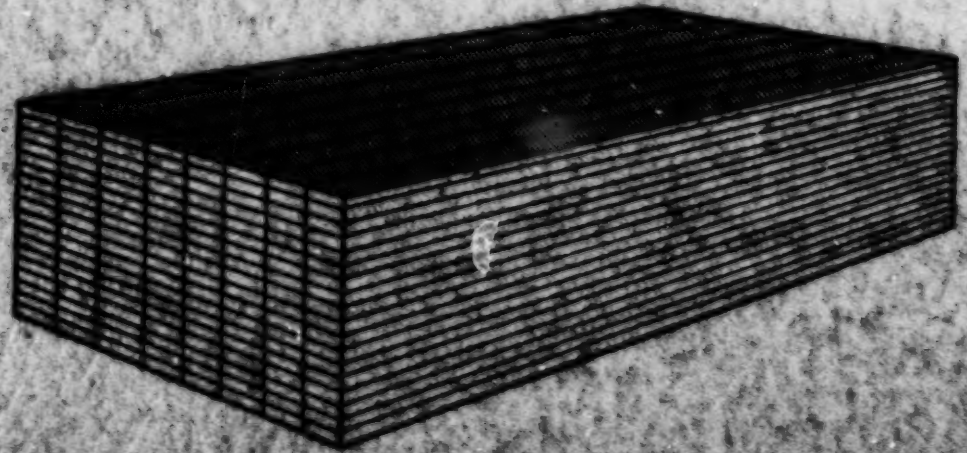

SPECIAL PUBLICATION NO. 23

CHEMICAL OPPORTUNITIES FOR LUMBER PROTECTION

Proceedings of a Joint Forintek Canada Corp.
and COFI workshop held March 22, 1985, at
Forintek Canada Corp., Western Laboratory, B.C.

Moderator: R.S. Smith
Secretary: A. Byrne

These precedings represent to the best of our knowledge the substance of the workshop. Should any errors or omissions be present, these are quite unintentional and result from the process of transcription.

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SUMMARY

On March 22, 1985, Forintek Canada Corp. and the Council of Forest Industries of B.C. (COFI) held a joint workshop to discuss opportunities for the protection of lumber. This meeting arose from an increasing need of the lumber industry for alternate chemicals to chlorophenols and also because of the recent closure by Reichhold Chemicals Inc., in Tacoma, Washington State of their plant for chlorophenol production. The workshop was attended by 57 people, representing the lumber industry and lumber manufacturing associations of B.C., the International Woodworkers of America, chemical suppliers and chemical formulators from across North America, research organizations in wood protection, and the federal government departments of agriculture and environment.

The two objectives of the workshop were described by Mr. French, President of Forintek, during his opening remarks. These were, to obtain technical information on alternate chemicals to chlorophenates for lumber protection and to provide a forum for the exchange of information on alternate chemicals for lumber protection between chemical suppliers, formulators, the forest industry and Forintek.

Mr. Chapotelle (COFI) gave an overview of the lumber industry in Canada and described the essential and pivotal role played by chemical protection, particularly to our export markets offshore. He encouraged the chemical industry to provide effective formulations that were non-leachable, safe for people to use and compatible with water repellents.

Presentations were then made about specific chemicals by the following people: P. Hartman (Buckman Laboratories)--2-thiocyanomethylthio benzothiazole (TCMTB); W. Goodwine (Janssen Pharmaceutica)-- Azaconazole; R. Reck (Akzo Chemie)--alkylammonium compounds; C. White (Dow Corning)-- trimethoxy silane; J. Yuster and J. Hansen (Troy Chemical)--3-iodo-2-propynyl butyl carbamate (IPBC); L. Jepperson (Chemcraft Sadolin)--IPBC formulations; and B. Smythe (Erco Industries Ltd.)--methylene bis thiocyanate (MBT).

Mr. L. McLelland (Agriculture Canada) described the method of registration for products under the Pest Control Products Act and the differences between temporary and emergency registration, research permits and the full data package requirement. Agriculture Canada was willing to discuss the phasing in of toxicity data for a formulation where there was a clear commitment to collect the whole data package at a later date.

The current and future research program in wood protection at Forintek Canada Corp. was discussed by Mr. Csorjesi, Mr. Byrne and Dr. Smith. The projects described included the field evaluation of new formulations, laboratory test methodology, use of water repellents, source of decay in packaged lumber, and diffusion treatment with boron systems. Dr. Smith then indicated Forintek's immediate plans to field test several promising formulations and he encouraged interested companies to supply Forintek suitable for Agriculture Canada. A research permit would be required from Agriculture Canada to allow such mill trials to proceed.

Lastly, Mr. R. Neil (Whonnock Industries Ltd.) reviewed the events of the workshop and then committed the COFI Sawmill Operations Committee to coordinate future industrial, environmental and worker interests in solving the problems described during the day. The importance of the issues discussed required immediate action and Mr. Neil pledged his support in giving the matter the highest priority.

AGENDA

Moderator: R.S. Smith

0900-0915	1. Welcome to attendees	Mr. K.A. French, President Forintek Canada Corp. Vancouver, B.C.
0915-0945	2. Lumber industry overview	Mr. D. Chapotelle COPI, Vancouver, B.C.
0945-1015	3. Alternate chemicals presently available or under test	Attendees presentations
1015-1035	Coffee	
1035-1200	Alternate chemicals presently available or under test (continued)	
1200-1300	Lunch	
1300-1345	4. Pesticide registration in Canada	Mr. L. McLelland Agriculture Canada Pesticide Division Ottawa, Ont.
1345-1445	5. Current and future research at Forintek Canada Corp.	Dr. R.S. Smith Mr. A.J. Caerjesi, and Mr. A. Byrne Forintek Canada Corp. Vancouver, B.C.
1445-1505	Coffee	
1505-1525	6. Field testing chemicals to meet the future needs of the lumber industry	Dr. R.S. Smith Forintek Canada Corp. Vancouver, B.C.
1525-1545	7. Opportunities for mill trials	Mr. D. Chapotelle COPI, Vancouver, B.C.
1545-1615	8. Review of workshop, future directions, time frame and reporting process	Mr. R. Neil Whonnock Lumber Vancouver, B.C.

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Western Laboratory, Vancouver, B.C.

1. WELCOME

K.A. French,
President, Forintek Canada Corp., Vancouver, B.C.

Mr. French welcomed the workshop participants to Forintek, Canada's forest products research institute. He described how Forintek is funded by two levels of government and by industry, and is committed to working with the forest industries in solving problems such as the one under discussion at this workshop.

Today three billion board feet (fbm) of coastal lumber is treated with antistain chemicals. Kiln drying could be considered an alternative method of protection for lumber, but at a cost of approximately $45 per Mfbm this is not economically feasible, especially given the existing small profit margins on lumber. Industry, therefore, has to depend on chemical treatments. The objectives of the meeting were then given as:

1. To obtain technical information on alternate chemicals to chlorophenates for lumber protection.

2. To provide a forum for the exchange of information on alternate chemicals for lumber protection between chemical suppliers, formulators, the forest industry, and Forintek.

He concluded by wishing the participants a productive day in working towards solutions for this important issue.

R.S. Smith, Research Scientist,
in charge of Wood Protection, Forintek Canada Corp., Vancouver, B.C.

Dr. Smith introduced the team from Forintek and COPI who were responsible for coordinating the meeting. Participants were then invited to introduce themselves. Smith then restated that the intent of the meeting was to provide technical information and that everyone who so wished would be given an opportunity to speak.

2. LUMBER INDUSTRY OVERVIEW

D. Chapotelle, Manager,
Lumber Operations Services, Council of Forest Industries, Vancouver, B.C.

Mr. Chapotelle supplied information which put the problem of sapstain and mould prevention into perspective. Seventy seven percent of the coastal B.C. lumber production, valued at $1 billion, is chemically treated for the prevention of stain and mould. This represents about 25 percent of Canadian lumber sales value. In terms of volume, three billion fbm of coastal and 0.5 billion fbm of interior lumber is treated. About half of this stock is doubly treated giving a total of 5.2 billion fbm chemically treated in B.C. Given the fact that a major objective of COFI is to diversify into markets away from North America as much as possible, the importance of this treatment is clear. The problem is especially important with hem-fir lumber which represents 60 percent of the mature coastal standing timber. With the high costs of transporting hemlock and fir logs to the mill and the lower production of these older mills, the profit margin on hem-fir lumber manufacturing is small. Kiln drying of hem-fir is about three times as expensive as drying interior spruce-pine-fir (S-P-F) lumber (ca $45 vs. $15 per Mfbm). There is a major committment on COFI's part to expand markets for hem-fir and the 40 - 50 percent of production shipped offshore will have an ongoing requirement for antistain treatment. As the trend towards producing larger sizes of S-P-F continues the requirements of chemical protection for this type of lumber will increase. The Japanese market is expanding gradually and requires a very clean product.

Lumber takes, on average, two and a half to three months to get from the mill to the buyer. A slide presentation outlined the type of deterioration problems which might be anticipated with such delays between mill and customer. In 1981, 20 percent of the S-P-F, KD, S4S, lumber exported offshore was the subject of monetary claims because of deterioration. As a result of this problem the Transit Protection Task Force was formed. Subsequently, wax emulsion treatments (for water repellency) were used on a large scale.

Mr. Chapotelle ended by encouraging the chemical industry to produce a chemical which would offer protection of lumber, be non-leachable, safe for people to use, and compatible with water repellents. The objective must be to ensure that the lumber arrives in the marketplace in the same condition as it left the sawmill.

Discussion

R. Arsenault emphasized that the toxicity of the lumber at the journey's end must be a consideration, e.g., Captafol-treated lumber from New Zealand has a reputation of causing skin rashes.

C. White mentioned the need to take into account different national standards. For example, organotin compounds are not permitted on textiles in Japan while they are in other countries.

3. ALTERNATE CHEMICALS PRESENTLY AVAILABLE OR UNDER TEST

P. Hartman, TCMTB Development Manager, Buckman Laboratories, Memphis, TN, USA

Mr. Hartman explained that Buckman is a major manufacturer of microbicides and has an interest in the protection of wood. 2-(thiocyanomethylthio) benzothiazole (TCMTB) is manufactured as a dark viscous liquid with 80 percent active ingredient and 20 percent inert ingredients, density 1.38 g/cm^3, flashpoint over 110°C, and solubility in water of 0.33 percent. This chemical is sold as an emulsifiable concentate and is used worldwide. TCMTB has replaced polychlorinated phenols (PCPs) as the number one preservative used in the North American leather industry. It is used as a sapstain and mould preventive for lumber and round wood as well as a heavy duty preservative, e.g., for landscape timbers. Mr. Hartman claimed that TCMTB can be used with existing equipment in sawmills and that the company offers a reliable chemical supply and has a committment to the good service of customers--for example, monitoring of the environment at the mill.

Discussion

J. Gardner asked about the chemical retention required for protection.

- The questioner was referred to the Forintek study.

H. Martin asked about the toxicology and emphasized the importance of including such data in today's presentations.

- Buckman is working with Agriculture Canada and is on the way to meeting their requirements for a toxicity package.

D. Pawsey wished to know the current status of TCMTB used for sapstain and mould prevention.

- TCMTB is fully registered for Canadian use and has been used by one or two mills in B.C.

S. Eaton mentioned problems in making TCMTB/wax formulations.

J. Leach asked when the registration had been done and whether a more stringent examination of the chemical might be required for re-registration.

- Registration was done in 1976 under the Pest Control Products Act. Buckman is discussing data requirements for re-registration with Agriculture Canada.

J. Leach emphasized that all contributors should give details of impurities contained in their formulations since it was the dioxins and dibenzofurans which had caused the bulk of the problems with the chlorinated phenols.

- Agriculture Canada has stringent requirements for chemical data as part of its registration requirements. This agency was the first in the world to demand such data and is in a position to judge if contaminants are of significance. Certainly TCMTB contains no dioxins.

R. Blanchard asked about the cost of TCMTB.

- It is more expensive than chlorinated phenols but it is inevitable that substitutes will be more expensive.

W. Goodwine, Manager,
Agricultural and Industrial Product Development, Janssen Pharmaceutica, NJ, USA

Janssen Pharmaceutica, a Belgian affiliate of Johnson and Johnson, manufactures, among other chemicals, several compounds for agricultural uses. Mr. Goodwine introduced azaconazole as a potential sapstain and mould preventive. This compound is a powder with a melting point of 100°C. It has very low vapor pressure and is stable in solutions between pH 1 and 9, and up to 300°C. Oral LD_{50} is 308 mg/kg for rats and 1,123 for mice. Dermal LD_{50} is $>$ 2,500 mg/kg. The fungicide is not easily leached but is broken down in soil (half life in a test sandy loam was 350 days). It is light-stable and well metabolized in mammals (95 percent excretion in 96 hours for rats). Azaconazole may be used to produce either solvent- or water-based formulations and is easily handled though a "caution" label applies. Toxicity to fish is relatively low with LC_{50} of 13 - 30 ppm (six species of fish) and 0 - 86 ppm for aquatic invertebrates.

Fungicidal efficacy results for azaconazole are now being compiled. Results from South Africa indicate that green lumber dipped for 30 seconds in solutions containing 3,000 ppm was adequately protected. Work is progressing on formulations with water repellents and/or with other active ingredients.

Discussion

D. Chapotelle asked about disposal of residues--for example, is it feasible to burn them.

- This aspect is under investigation.

R. Arsenault wanted to know the costs of azaconazole relative to chlorinated phenols.

- The chemical costs are ca $25 (U.S.)/lb. and for equivalent concentrations will be about three times the cost of NaTCP. However, the recommended rates of application are less than those recommended for chlorinated phenols.

R. Reck, Director of Commercial Development, Akzo Chemie America, Chicago, IL, USA

Dr. Reck introduced AkzoChemie (formerly Armak and Armour Chemical companies) as worldwide manufacturers of N_2-derivatives. Quaternary ammonium compounds, also known as alkyl ammonium compounds (AAC's), are made from fatty acids (e.g., from coconut and soya oils). These compounds have found wide usage, for example, as sanitizers (100 million lb/yr in the U.S.) and are now being used in wood protection and wood preservation, particularly in Europe. Because of their wide usage much toxicity data has been accumulated. LD_{50}'s are relatively high, 250 - 6,350 mg/kg. Biodegradation is rapid with AAC's largely degraded within 48 hours in soil. Generally, they are environmentally safe, though a major spill (producing one to two percent AAC content) may overload a sewage system and kill the sewage bacteria.

In the U.S., five AAC biocides are registered for formulation as sanitizers. For wood protection it is probable that the AAC by itself will not be sufficient and a formulation involving other chemicals will be required. The present company has good laboratory facilities in Europe for developing such formulations and for subsequent biological testing.

As fungicides the didecyldimethyl and the benzalconium (12-14 carbon chain) compounds are the most potent. Costs vary from $1 - 2.25 (U.S.) per lb.

For wood protection, various AAC's are now under test and formulations are being registered. EPA registration for other uses has already been granted.

Discussion

J. Gardner asked if AAC's had been tested on lumber.

- Not only have they been tested, formulations are now used commercially in Europe.

J. Gardner further enquired about leachability.

- The compounds are cationic and therefore attracted to the anionic surface of wood. They are leached, but slowly.

G. Paynter asked about the odor of AAC's.

- The odor is negligible, however, when heated to 150°C unpleasant decomposition products result.

D. Konasewich enquired about the toxicity of AAC's to fish and generally emphasized the importance, in BC, of such data.

- This data has been obtained and will be available to those requesting it. Dr. Reck understood that the AAC's have passed stringent tests for fish toxicity.

R. Smith commented that such information would be made available in the record of the proceedings if it were forwarded to the workshop organizers.

C. White, Dow Corning, Midland, MI, USA

Mr. White indicated that Dow Corning was now interested in supplying the forest products industry with sapstain and mould preventives. As manufacturers of silanes and silicones they propose that trimethoxy silane $[(CH_3O_3)\ Si(CH_2)_3\ N(CH_3) - C_{18}\ H_{37}]^+\ Cl^-$ will be a potential substitute for chlorinated phenols.

This chemical builds a surface film in which the compound bonds both to itself and to the wood substrate. It is durable, safe, and offers broad-spectrum toxicity to bacteria, fungi, and algae and has already been commercialized for use on alternate cellulosic surfaces such as textiles. The chemical film is relatively non-leachable. Its efficacy on wood is being investigated at Dow Corning and at the Madison Forest Products Laboratory. Toxicity data is available and favors use of the chemical. Oral LD_{50} is in terms of g/kg (rather than mg/kg) and results of acute toxicity tests are available as well as results of gene mutation, transformation and teratogenic tests.

In the U.S. the compound has already been registered by the EPA and FDH, though not for use on wood. It is listed by Agriculture Canada as a textile preservative and is currently being used world-wide as such.

In summary, although this chemical is still being tested, it deserves serious consideration as a wood protecting agent, particularly because of its low mammalian toxicity.

Discussion

J. Gardner asked if heat treatment was a requirement to achieve the types of chemical bonding described.

- Heat and/or drying helps but a curing period is not required as for other polymerization reactions. It is important to avoid

extremes of pH. In water solutions of five percent the chemical will not drop out of solution or polymerize. The cationic nature of the active ingredient is a decided advantage.

J. Yuster, Registration Officer, Troy Chemical, NJ, USA

Troy Chemicals decided some time ago to supply raw materials and not to formulate them. Ms. Yuster gave information on Troysan Polyphase. This is 97 percent 3-iodo-2-propynyl butyl carbamate (IPBC). Toxicology tests on IPBC are continuing. It has an LD_{50} of 1,470 mg/kg for rats and an LD_{50} (dermal) of $> 2,000$ mg/kg. It is classed as non corrosive but is an eye irritant and eye corrosive material (both reversible) before, but not after, formulation. Inhalation toxicity is > 6.5 mg/l. IPBC has proved negative in both Ames and micronuclear tests. A 90 day feeding study indicated no mutagenicity. IPBC is fairly toxic to fish (LC_{50} for fish 1 - 2 ppm). The vapor pressure of the compound is very low ($< 2 \times 10^{-5}$ mm Hg). The compound has been cleared for use in Europe, including the UK and Germany, and has met (U.S.) EPA requirements for about eight years now.

J. Hansen, Manager, Troy Chemical, NJ, USA

Mr. Hansen took the time to look at the basic problem of control of sapstain and moulds. The objective must be to find a new sapstain product (and the word "product", rather than chemical should be emphasized) which:

a) significantly reduces the loss in value of the wood due to biological factors, and
b) reduces the health and environmental risks associated to acceptable levels for both industry and regulating authorities.

Point a) implies that the product should not only economically protect but that it should be easy to handle, i.e., stable in aqueous solution or emulsion. The antistain treatment should be non-corrosive to machinery and should be capable of automatic dosing into the dip tank or spray system. Ultimately, assessment of effectiveness of a treatment requires determination of whether there has been reduction in commercial value and not some academic concept related to the growth of fungi. Assessment of trials should therefore be done using industrial standards. Screening tests have value but practical tests in practical situations are the most important indicators of efficacy. Mr. Hansen felt that it was important not to inoculate in an accelerated test because this would change the natural fungal colonization process and perhaps distort results. He mentioned that stickering of piled lumber to reduce growth of fungi is a recommended practice.

L. Jeppesen, Chemcraft Sadolin, Ont.

Woodgard EC was developed after looking at a number of different biocides. It is supplied as an emulsifiable concentrate containing seven percent IPBC and four percent carbendazim. Ms. Jeppesen's company chose to use a mixture of chemicals because too many weaknesses were apparent in single chemical formulations. The two chemicals selected are compatible and complementary; IPBC is effective against moulds and wood-destroying fungi while carbendazim is effective against staining fungi. There may be a synergistic effect between these two components but this is unproven. The formulaton is very stable and non-corrosive.

Practical trials have been done with generally positive results. However, tests have shown, and this is probably applicable to other formulations, that results from one area of the world are not necessarily valid for another. In general, a formulation should be tested where it is going to be used if we are to obtain meaningful results. In Finland 0.6 percent (a.i.) is effective (one year test); indications are that one percent will be effective in most other parts of the world although in B.C., with its apparently high hazard, perhaps two percent will be required. In B.C. the formulator is cooperating with Van Waters and Rogers in the development of a commercial product.

Discussion

D. Chapotelle felt that information on chemical compatibility with water-repellents, leachability and disposal of residues had been largely overlooked by chemical companies represented today, and he wondered how IPBC formulations were in this regard.

- There would be no difficulty in formulating IPBC with a water repellent especially since the compound (more soluble in organic solvents than in water) is probably compatible with waxes. Nonetheless this would require testing as would leachability. Incidentally, leaching is not a problem in other countries, such as in high rainfall parts of Africa where lumber piles are designed to shed the rain. This could be tried in B.C. Studies indicated that the residue (sawdust, etc.), which accumulates in the bottom of dip tanks, does not show an accumulation of chemicals. Further, disposal of excess chemical is not a problem since the product is destroyed completely in combustion and does not produce toxic wastes.

R. Arsenault, Aminex Corp., Seattle, WA, USA

Mr. Arsenault was asked for comments, based on his experience in wood protection/preservation. Having tested 500 to 600 formulations in his career he stated that it was evident that the formulation was more important than the active ingredients used. Chemical stability and penetration into the wood were two

important factors which could be controlled by the formulation. For example, for PCP's alone, many formulations are not suitable for sapstain and mould control, also, several formulations of methylene- bis-thiocyanate are unstable and the active ingredient can easily fall out of solution. Small changes in formulation can make large differences in efficacy, e.g., inclusion of a small amount of a lithium salt (rather than Na or K) in a Koppers' formulation significantly increased its potency.

Mr. Arsenault cautioned against those who would use mill trials without controlling all of the many variables involved. Two further points were that potential mould and stain preventives should not discolor wood unduly and that it is necessary to know the answers to all potential problems before marketing a new sapstain and mould formulation.

B. Smythe, Erco Industries Ltd, North Vancouver, B.C.

As a local representative of Tenneco Organics Ltd., Bryan Smith pointed out that methylene-bis-thiocyanate was cost effective, compared with the PCP's, as a sapstain and mould preventive. The chemical is registered in Canada for other uses and has an excellent safety record. A comprehensive package of toxicity data is available upon request.

4. POSITION OF AGRICULTURE CANADA AND THE REGISTRATION OF NEW CHEMICALS

L. McLelland, Evaluation Officer,
Pesticide Division, Agriculture Canada, Ottawa, Ont.

Mr. McClelland began by recognizing that Canada probably has the most stringent demands of anywhere in the world for registration of products under the Pest Control Products Act. Registration of any product involves a long and expensive process requiring the provision of data in the following areas: acute LD_{50} (oral, dermal), eye irritation, dermal sensitization, neurotoxicity, long-term feeding, oncogenicity, mutagenicity, teratogenicity, pharmaeokinetic studies and reproduction studies.

The estimated cost is $3 - 4 million and the data is required before registration can be granted.

Temporary registration may be granted if there is a committment to supply all this data and results are already underway. Such registration, however, implies that at least 75 percent of the costs of the required data package have been spent.

Emergency registration is possible for emergency situations, when considerations of health vs. economics decide in favor of the use of a chemical.

Research permits are the lowest level of registration permissible and cover only the acquisition of efficacy data involving mill trials of about 20,000 Mfbm. Testing of different species, or at different locations, will be considered in granting such permits. There have been only one or two applications for research permits and none have been brought to fruition, although this route is still open.

The full data package required for registration of a new active ingredient is also a requirement where a new market is to be found for a known active ingredient.

Mr. McLelland mentioned that the intent of the legislation was to protect the public, but since no chemicals have been registered since the legislation was brought in, it was valid to ask if the Pest Control Products Act was serving public interest. In particular, was the Act perhaps hindering development of substitutes for the chlorinated phenols and thereby perpetuating the use of this undesirable chemical? Agriculture Canada was now prepared to discuss the phasing in of toxicity data where there was a committment to collect the whole data package. The flexibility would be on timing, not on the total data requirements. Although it is unlikely to be an issue with the sapstain and mould chemicals, data from one manufacturer would not be used for registration of a competitor's product without written permission from the originator of the data.

Discussion

H. Martin asked how practical it was to expect a chemical manufacturer to phase in toxicology data without the product being allowed at least limited commercial use.

- The speaker meant to imply that limited commercial use was allowable here. It was the committment to obtain the toxicological data that was important.

Another participant asked if all ingredients of a formulation had to have toxicity data and commented that the (U.S.) EPA was now critically appraising inert ingredients and asked if that was envisaged in Canada..

- Toxicity data must be available on active ingredients but truly inert components are allowed without such data. Resources have not yet permitted examination of all active ingredients and it is unlikely that inert components will be scrutinized in the near future.

R. Smith asked if the incorporation of water repellents into a formulation would require extra registration data.

- If the water repellent were a familiar substance, e.g. wax, there would be no extra requirement, however, for other unknown repellents, questions would be asked.

S. Gardner enquired as to the Agriculture Canada policy on review of long-registered chemicals.

- A review process in underway but it will take a while to complete re-registration of old chemicals.

R. Blanchard asked why the use of temporary permits was so limited.

- Temporary registration requires a committment to obtaining complete toxicologial data and is, in practice, not so easily obtained as the title may imply.

5. CURRENT AND FUTURE RESEARCH AT FORINTEK

A. Byrne, Scientist, Forintek Canada Corp., Western Laboratory, Vancouver, B.C.

Mr. Byrne described three laboratory efficacy tests done on a standardized basis at Forintek. The first was a screening test used to estimate the action of a test fungicide against specific pure cultures of moulds, staining, or wood-destroying fungi grown on agar plates. Results were presented which indicated differing fungal specificity for different active ingredients. However, the overall inhibitory effects of several fungicides of interest to the workshop were remarkably similar.

The second test, now an ASTM standard, uses small pieces of sapwood dip-treated in fungicide and inoculated with staining or mould fungi. Successful treatments result in clean samples after the four-week test period. This test is suitable for quickly comparing fungicidal efficacy on a wood substrate. It can be used, for example, for mixtures of components, to determine effective formulations.

The third test examines efficacy in preventing the spread of wood-destroying fungi within miniature packages of wood beams. Wood pieces infected with commercially important fungi are incorporated into these packages of beams which have been dip treated with test fungicides. After incubation, the effectiveness of a formulation can be estimated from the rate of spread of the fungus from the inoculated pieces.

A.J. Cserjesi, Research Scientist, Forintek Canada Corp., Western Laboratory, Vancouver, B.C.

Mr. Cserjesi began by describing the ideal chemical treatment for lumber. The chemical should be toxic to all fungi but non-toxic to humans and other higher forms of life. It should be permanent while its activity is required but should disappear after its function has been fulfilled. He described the Forintek field test used to estimate the efficacy of chemical formulations for prevention of stain, mould, and decay in

lumber. The test involves dip-treatment of eight foot long, 2 x 4 inch, lumber in selected concentrations of the formulation under test. The pieces are inoculated with fungi to ensure infection of inadequately treated lumber. Eighty pieces of each treatment level are packaged, wrapped, and stored for 4 or 16 months at which time evaluation for deterioration of the lumber is done.

Results were presented for six formulations tested on three wood species under contract to Agriculture Canada. All chemicals showed fungicidal efficacy but effective concentrations varied.

Chemicals tested in the past include Captafol, Folpet, Thiabendazole, Benomyl, TCMTB, MBT, ZnO/ammonium thiocyanate, Thiostop, IPBC , Denicide, Nitrol 48 and 60, and alkyl ammonium compounds. Efficacy varied, though at equivalent concentrations most offered protection inferior to that of NaTCP.

R.S. Smith, Research Scientist, Forintek Canada Corp., Western Laboratory, Vancouver, B.C.

Dr. Smith described the Forintek, Wood Protection research program for the next year. Emphasis would be directed towards:

1. Novel spray technology with the intention of better control of the spraying process and reduced overspray.

2. Continuing evaluation of fungicidal formulations to identify promising new compounds and formulations. A lumber spray system will be acquired to enable field testing of candidates for replacement of the chlorinated phenols. The leachability of test formulations will be examined.

3. The area of water repellent treatments for lumber. Test procedures for estimating water repellency and related characteristics, such as slipperiness, will be identified.

4. Investigation of the source of decay in sawn lumber.

5. The feasibility of diffusion treatments of lumber particularly using boron systems.

Discussion

J. Leach enquired how the test concentrations of fungicides are determined.

- These are based on the manufacturers' recommendations and field testing levels are half and twice this level, in addition to the recommended level. Sometimes levels of one third and three times are used. The retention of fungicide by the wood depends on the surface characteristics (rough cut lumber absorbs more) and this must also be borne in mind.

R. Blanchard wondered why Cu-8 levels tested in the field test for Agriculture Canada were so low. Couldn't this chemical be tested at higher concentrations, and if successful, be used in sawmills?

R. Smith understood that efficacy was not the sole reason for discontinuing the experimental use of the chemical at a Vancouver Island mill and that corrosivity had been a factor.

H. Martin said that it was his company (MacMillan Bloedel) which had tried PQ-8. They used it at higher concentrations than those tested in the field test referred to, but that it was still not fully effective. Corrosion was a big problem. Additionally, the treated lumber was particularly susceptible to iron stain.

J. Hansen remarked that increasing the concentration of a chemical beyond a certain point often resulted first in a slight decline in efficacy; further increases gave only slight increases in efficacy. Increasing the concentration was therefore not always a practical answer to the need for better protection.

D. Fussell mentioned that in the Agriculture Canada test NaTCP was tested at levels higher than those recommended by the formulator and that in retrospect levels of Cu-8 treatment should also have been higher. A further factor to consider is that it is hard to make Cu-8 compatible with water repellents (waxes). However, his company is continuing to work on this problem and he is generally optimistic that successful formulations of Cu-8 will be available in the future.

J. Hansen drew the attention of the workshop to stabilizing problems with Folpet (which hydrolyzes) and Benomyl (which decomposes to carbendazim). He warned that excess use of water repellents might give problems with paintability of the wood surface.

D. Chapotelle said that the slipperiness problem associated with waxes was directly attributable to overtreatment at a sawmill.

C. White requested that the audience be aware of the difference between silicones and silanes; only the former are water repellents.

6. FIELD TESTING NEW CHEMICALS

R.S. Smith, Research Scientist in charge of Wood Protection, Forintek Canada Corp., Western Laboratory, Vancouver, B.C.

Dr. Smith committed Forintek to evaluating a number of promising formulations over the next few months in a field test. The costs of the field test will be borne by Forintek so that the results can be made freely available and tight technical control of the project can be maintained. This field test will follow the previously outlined method which gives practical results relatively quickly. Completion of the field test is anticipated by fall of 1985.

The decision as to which formulations are to be tested will be partially based on information presented today. Forintek has a committment to communicating the results from the test to industry.

7. MILL TRIALS--PROPOSALS FOR 1985/86

D. Chapotelle, Manager, Lumber Operations Services, COFI, Vancouver, B.C.

Mr. Chapotelle emphasized the importance of eventually testing potential antistain chemicals in the real world and mill trials offer the best solution. He suggested that any company wishing to test a chemical ask for a research permit from Agriculture Canada to cover three wood species groups, spruce-pine-fir, hem-fir and Douglas-fir, and recommended two tests per species at different locations. Each of these tests should involve about 25 Mfbm. Tests should preferably be done in the peak-problem period of May to September and preferably the tested material should then embark on a long overseas journey, for example to Europe, where it can be assessed. The formulators of test fungicides should be present to witness the treatment. COFI will assist in arranging with mills to have such tests done. Mr. H. Kettner was then introduced as the COFI representative in Europe for the next two years. He would be able to assess lumber at its destination ensuring a consistent measure of its condition. It is important to note that the objective is to find formulations which are less toxic than the chlorinated phenols and formulators should be certain that their product is an improvement over NaTCP before requesting mill trials. Also, some assurance of efficacy in service should be offered by the formulator prior to undertaking mill trials.

Discussion

J. Rockandell mentioned that it was his understanding that granting of research permits implied there was a committment to obtaining toxicity data. What details would be required for research permits?

L. McLelland. Applications for research permits should include details of the time, locations, and total amount of product to be involved in the test. The names of the industrial cooperators must be specified.

J. Hansen reiterated that evaluation of treated materials after practical trials should be based on the economic devaluation (or otherwise) of the product.

8. REVIEW OF WORKSHOP, FUTURE DIRECTIONS

R. Neil, Chairman of the COFI Sawmill Operations Comittee and Vice-President in charge of Manufacturing and Marketing for Whonnock Industries Ltd.

Mr. Neil stated that the function of the Sawmill Operations Committee was to oversee quality control of the product of COFI mills and their affiliates which account for 90 percent of B.C.'s lumber production. It was unfortunate that a crisis (the closure of Reichhold's Tacoma plant) had to happen to bring the participants together today, but Mr. Neil felt that often it took a crisis to ensure human response and action. Industry had been hoping that a magical product for stain and mould prevention would appear, and that it would be economically competitive with chlorinated phenols. That seemed no longer possible. There had been a gap in communications which this workshop had bridged. Now participants has a good idea of possible alternatives and realized, for example, that research permits allowed mill trials. The objectives of the workshop, to present technical information on products and to act as a forum for exchange of ideas, had been admirably met. A review of the presentations then followed.

Mr. Neil stated that the Sawmill Operations Committee will become more involved with the problem at hand. He restated that Forintek is committed to field testing alternative sapstain or mould preventives and committed industrial cooperation. His committee was further committed to coordinating industrial, environmental, and worker interest in solving this problem. The importance of the issue required immediate action and he pledged his support in giving the matter the highest priority. In closing, Mr. Neil thanked the organizers of the workshop.

R. Smith concluded the workshop by asking participants to send technical data on products offered for inclusion in the proceedings. Anyone wishing that such information not be distributed should specify so and confidentiality would be fully respected. Dr. Smith thanked the participants and bid them a safe journey home.

APPENDIX I

LIST OF PARTICIPANTS

LIST OF PARTICIPANTS

Arsenault, R.	Aminex Corp.	Federal Way, WA
Blanchard, R.	I.W.A.	Vancouver, B.C.
Bourke, L.	C.L.M.A.	Williams Lake, B.C.
Bullock, L.	Van Waters & Rogers	Vancouver, B.C.
Byrne, A.	Forintek Canada Corp.	Vancouver, B.C.
Chapotelle, D.	COFI	Vancouver, B.C.
Chow, S.	Canadian Forest Products	Vancouver, B.C.
Cooper, I.	Dow Corning	Mississauga, Ont.
Csorjesi, T.	Forintek Canada Corp.	Vancouver, B.C.
Eaton, S.	Cloverdale Paint	Surrey, B.C,
Ennis, R.	Forintek Canada Corp.	Vancouver, B.C.
Fussell, D.	Chapman Chemicals	Memphis, TN
Gardner, J.		Vancouver, B.C.
Gardner, S.	Dow Corning	Midland, MI
Goodwine, W.	Janssen Pharmaceutica	NJ
Hall, L.	Walker Bros.	Vancouver, B.C.
Hansen, J.	Troy Chemical Corp.	Newark, NJ
Hartman, F.	Buckman Labs.	Memphis, TN
Hawrysh, B.	COFI	Vancouver, B.C.
Hough, P.	Van Waters & Rogers	Vancouver, B.C.
Jefferys, T.	Cascade Chemical	Vancouver, B.C.
Jeppesen, L.	Chemcraft Sadolin	Port Hope, Ont.
Johnson, E.	Forintek Canada Corp.	Vancouver, B.C.
Johnstone, T.	Buckman Labs	Montreal, P.Q.
Kettner, H.	COFI	Vancouver, B.C.
Konasewich, D.	Envirochem	Burnaby, B.C.
Leach, J.	B.C. Research	Vancouver, B.C.
McCann, M.	Rohm & Haas	Philadelphia, PA
McClelland, L.	Agriculture Canada	Ottawa, Ont.
McCordock, A.	Chapman Chemicals	
Madrigga, M.	NILS - COFI	Prince George, B.C.
Maguire, E.	Emchem	North Vancouver, B.C.
Martin, H.	MacMillan Bloedel	Vancouver, B.C.
Miller, T.	Diachem Ind.	Richmond, B.C.
Moore, M.	Alchem	North Vancouver, B.C.
Mordy, C.	Cloverdale Paint	Vancouver, B.C.
Neil, R.	Whonnock Industries	Vancouver, B.C.
Pawsey, D.	Rohm & Haas	Vancouver, B.C.
Paynter, G.	Van Waters & Rogers	Richmond, B.C.
Reck, R.	Akzo Chemie	Chicago, IL
Robinson, C.	Harrisons & Crosfield	Vancouver, B.C.
Rockandel, J.	Diachem Ind.	Vancouver, B.C.
Rosenberg, G.	Forintek Canada Corp.	Vancouver, B.C.
Schaffer, R.	Armack Chemicals	Edmonton, Alta.
Singh, B.	May & Baker	Ont.
Smith, R.	Forintek Canada Corp.	Vancouver, B.C.
Smyth, B.	Erco	North Vancouver, B.C.
Sutherland, A.	Van Waters & Rogers	Vancouver, B.C.
Tittler, K.	Diachem Ind.	Vancouver, B.C.
Toms, D.	MacMillan Bloedel	New Westminster, B.C.

LIST OF PARTICIPANTS/CONT'D

Vogel, A.	Cloverdale Paint	Vancouver, B.C.
Watkins, J.	Ferro Corp.	Toledo, OH
White, C.	Dow Corning	Midland, MI
Wile, K.	Environment Canada	Vancouver, B.C.
Wilson, D.	Envirnmental Protection Service	West Vancouver, B.C.
Wong, L.	Walker Bros.	Vancouver, B.C.
Yuster, J.	Troy Chemical	Newark, NJ